ENDANGERED SPECIES ACT - SECTION 7

BIOLOGICAL OPINION

Denny Way/Lake Union CSO Control Project
WSB-00-039

Agency: U.S. Environmental Protection Agency

Consultation
Conducted By: National Marine Fisheries Service
Northwest Region,
Washington State Habitat Branch

Approved Russell M. Strach for Date June 19, 2000

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A. Background and Consultation History

In many cities the sewage system is designed to carry both sewage and stormwater (street runoff). Conceptually, this simplifies the underground plumbing and thus saves money. The difficulty is that most of these systems do not have the capacity to transport all of the water that enters the system during a storm event. To take care of these storm events, cities with combined systems usually install Combined Sewage Overflow (CSO) outlets at various (and numerous) locations in local water bodies. These CSO outlets are generally designed to let combined sewage and stormwater overflow into local aquatic environments without benefit of sewage treatment.

In Seattle, the combined sewage/stormwater system is located in the older portions of the city and discharges combined sewage and stormwater into Lake Washington, the Ship Canal, Lake Union, the Duwamish River, Longfellow Creek, east central Puget Sound, and Elliott Bay. The number of times per year these CSOs release material is dependent on the number of storm events and the severity of each such event. In Washington, state law requires all municipalities with CSOs develop plans for "the greatest reasonable reduction at the earliest possible date" of untreated CSO discharge (RCW 90.48.480). State regulations define "reasonable reduction" to be one untreated discharge per year (WAC 173-245-020(22)). King County is on a schedule to be in compliance with this law by the year 2030. The Denny Way CSO project is a joint undertaking between the City of Seattle and King County comprised of two major components: 1) remove one existing CSO outfall in Lake Union, and 2) control other City of Seattle and King County CSOs to Lake Union and Elliott Bay. Controlled CSOs will meet the state regulations which limit untreated overflow events to a frequency of once per year from existing outfalls. These CSOs will be controlled by a strategy that combines 1) storage and transfer to a wastewater treatment plant, and 2) CSO treatment at-site with discharge through a new outfall into Elliott Bay. Discharges through this outfall are expected to occur eight to 20 times per year. In addition, a new outfall will be constructed in Elliott Bay to discharge untreated CSO event from the Denny Way CSO, on average once per year.

The lead federal action agency is the Environmental Protection Agency (EPA), through which King County is receiving funding for the proposed action. NMFS, EPA, and King County have continually communicated during this consultation. NMFS and King County have communicated closely during the development of the Biological Assessment that initiated and informed this consultation. Meetings began on March 5, 1999 with subsequent meetings on April 8, and May 3, 1999 culminating in completion by King County of the Biological Assessment (BA) on June 8, 1999. On that date, EPA and King County requested informal consultation and conferencing on King County's effect determinations of "may affect, not likely to adversely affect" chinook salmon (*Oncorhynchus tshawytscha*). Over the next several months, NMFS and King County staffs informally addressed the effects determination (see

Appendix A). Subsequently, NMFS determined that the Denny Way CSO project would likely adversely affect chinook salmon. This determination was made on November 15, 1999. Originally, the information necessary to complete the Biological Opinion was thought to be compiled by November 15, 1999. However, the monitoring plan for post project effects was not completed until May of 2000.

B. Description of the Proposed Action

This action is proposed by King County Wastewater Treatment Division, King County, Washington. King County would receive funding for this action through the United States Environmental Agency (EPA). Such funding creates a federal nexus triggering the need for consultation under Section 7 of the Endangered Species Act of 1972 (The Act), as amended. The aquatic phase of the construction for the proposed project will occur in Lake Union and Elliott Bay. The operation of the completed project will impact Elliott Bay and eastern central Puget Sound.

The elements of the proposed action that are relevant to an analysis of effects include the construction of the two outfalls in Elliott Bay, removal of one outfall in Lake Union, and the subsequent operation of the completed system.

The action area for the proposed Denny Way CSO project includes Lake Union, the Ship Canal from Lake Union to eastern central Puget Sound, Elliott Bay, and east central Puget Sound. Lake Union is located immediately north of downtown Seattle. The Ship Canal connects Lake Washington with eastern central Puget Sound and bisects Seattle from east to west. Elliott Bay is an embayment of Puget Sound located adjacent to the western edge of the central portion of Seattle (see appendix B of the BA for detailed maps). The area of central Puget Sound of interest to this document is that portion located from Duwamish Head north to Admiralty Inlet.

Lake Union is a fully urbanized freshwater lake, surrounded by the City of Seattle. It is connected upstream via the Ship Canal to Lake Washington and downstream via the Ship Canal to east central Puget Sound (see maps, Appendix B). Lake Union and the Ship Canal are part of the Lake Washington Drainage Basin. The Basin contains threatened Puget Sound chinook salmon.

Elliott Bay is a partially enclosed embayment of Puget Sound. It is surrounded on the south, east, and north by the City of Seattle and opens to eastern central Puget Sound on the west. Elliott Bay is the receiving waters for the Duwamish River which is the lower portion of the Green River and contains threatened Puget Sound chinook salmon. East central Puget Sound is part of the designated critical habitat for threatened chinook salmon (65 Fed. Reg. 7764).

Activities underlying the proposed action fall under two major categories. The first is the diversion of combined sewage and stormwater flows from the Lake Union and Denny Regrade areas to outfalls in Elliott Bay and east central Puget Sound. The second major outcome will be a reduction in storm

caused combined sewer overflow (untreated) events from about 50 to 75 per year (current status) to one per year (on average) at the Denny Way CSO and CSO 175. To accomplish these objectives, King County (with EPA funding) is proposing to build a large tunnel under Mercer Street in Seattle to act as both a transfer facility and storage container. The tunnel would be 6200 feet long by about 14 to 15 feet in diameter, which will allow for the storage of up to 7 million gallons of combined sewage and stormwater. City of Seattle CSO number 125 (that empties into Lake Union) will be eliminated and the effluent diverted into the Mercer Street tunnel. A 250-million-gallon-per-day (mgd) pump station and CSO treatment facility at the west portal of the Mercer Street tunnel, and two outfalls in Elliott Bay will be constructed. One outfall is for the once-per-year (on average) untreated CSO event and will be a 100 foot long extension of the existing CSO outfall, thereby moving the outfall to -20 feet mean-lower-low-water (MLLW). The other outfall will be about 490 feet long with the outlet at -50 to -60 feet MLLW, this outfall will be for effluent that has been processed by the treatment plant mentioned above. Construction of the outfall pipes will involve trenching the substrate from above mean-higher-high-water (MHHW) to near the end of the CSO outfall. The two pipes will be installed in the trench and covered with about 5 feet of uncontaminated backfill. The longer outfall pipe will continue on to its outfall site on the surface of the existing sediment and will be covered with a "concrete mattress" for protection. This pipe will be supported on concrete cradles which are supported by steel piling driven into the substrate. In addition, up to 40% of the combined sewage and stormwater stored in the Mercer Street tunnel will be diverted to Metro's West Point Treatment Facility for processing. The West Point facility is a secondary treatment plant that discharges into east central Puget Sound.

Thus, there are two different phases that will take place. The first is the construction of the facilities and the second is the operation and subsequent discharge of effluent into Elliott Bay and eastern central Puget Sound.

An additional action will be the introduction of intertidal and subtidal "structure" onto the substrate to enhance salmonid habitat. Specifically, large woody debris (logs) and boulders will be placed in and about the Elliott Bay construction site near the completion time of the project.

Conservation measures integrated into the proposed action include:

1. The construction period for the new outfalls and in-water work for removal of CSO number 125 would be scheduled from mid summer to mid winter. Operating during this time of the year will result in the lowest probability of doing any damage to chinook salmon habitat. Also, juvenile chinook salmon will not be present and the small amount of disturbed substrate will then have the rest of the winter and early spring to recover prior to outmigration of the juveniles.

2. King County would obtain a Hydraulic Permit (HPA) from the Washington Department of Fish and Wildlife (WDFW) and follow the restrictions listed in the permit.

3. The underwater dredge (digging) techniques used should be those that create the least amount of mobilization of the existing sediment.

4. Divers should be on site and check for juvenile chinook salmon during construction.

II. STATUS OF THE SPECIES AND CRITICAL HABITAT

The Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) Evolutionarily Significant Unit (ESU) may be adversely affected by the proposed action. For the purposes of conservation under the Act, an ESU is a distinct population segment that is substantially reproductively isolated from other conspecific population units and represents an important component in the evolutionary legacy of the species (Waples 1991). The geographic area of Puget Sound ESU encompasses the entire Puget Sound drainage basin west to the Elwah River basin and north to the Canadian Border. The Puget Sound chinook salmon ESU was listed as Threatened on March 24, 1999 (64 Fed. Reg. 14307). Details regarding the general status of the species at the ESU level are incorporated from the notice of final rule, by reference.

Critical habitat for the Puget Sound chinook salmon includes all marine, estuarine and river reaches accessible to chinook salmon in Puget Sound (65 Fed. Reg. 7764). Further details regarding the designation of critical habitat for the Puget Sound chinook salmon are incorporated from the notice of final rule, by reference. For this consultation, relevant critical habitat includes the Lake Washington/Cedar River basin to the Landsburg diversion dam and the Green/Duwamish River, Elliott Bay and east central Puget Sound. The subareas that may be effected by the proposed action include the freshwater habitat from Lake Union to Puget Sound, Elliott Bay, and east central Puget Sound from Duwamish Head to Admiralty Inlet.

III. EVALUATING THE PROPOSED ACTION

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA as defined by 50 C.F.R. Part 402 (the consultation regulations). NMFS must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the initial steps of (1) defining the biological requirements of the listed species, and (2) evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NMFS evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NMFS must consider the estimated level of mortality attributable to: (1) collective effects of the proposed or continuing action, (2) the environmental baseline, and (3) any

cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed salmon's life stages that occur beyond the action area. If NMFS finds that the action is likely to jeopardize, NMFS must identify reasonable and prudent alternatives for the action.

Furthermore, NMFS evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' critical habitat. The NMFS must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and recovery of the listed species. The NMFS identifies those effects of the action that impair the function of any essential element of critical habitat. The NMFS then considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NMFS concludes that the action will adversely modify critical habitat it must identify any reasonable and prudent measures available.

For the proposed action, NMFS' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. NMFS' critical habitat analysis considers the extent to which the proposed action impairs the function of essential habitat elements spawning, rearing, feeding, sheltering, or migration of Puget Sound ESU chinook salmon, when compared to the existing environmental baseline.

Typically, this information should include a description of the species status, specific to the action area. This would include mention of the extent of the range of the species comprised in the action area, whether any effects are qualitative, quantitative, or both, and description of the particular constituent elements of critical habitat effected within the action area. Finally, this section should cover the factors affecting species (critical) habitat within the action area, that is, what other actions inform the habitat condition in the action area (*e.g.*, historic timber harvest, road construction, other land uses).

A. Biological Requirements

Life History and Factors Affecting the Species in the Action Area. Chinook salmon have evolved two distinct life history strategies (Scott and Crossman 1973, Wydowski and Whitney 1979, Healey 1991, Myers et al. 1998). One strategy, described as "stream type," is where the juveniles spend one year or longer in freshwater residence after emergence from the egg stage. The other strategy is called "ocean type" because the juveniles migrate to marine waters soon after emergence from the egg stage. In addition, a small fraction of the "ocean type" juveniles may residualize for one year, thus they would appear to be "stream type" juveniles when they outmigrate. Besides the difference between the two life history strategies in freshwater there is a difference in how each uses the estuary. The "ocean type" juveniles generally inhabit the nearshore areas of estuaries and move off and into deeper waters as they grow and age (Healey 1991). The "stream type" juveniles, compared to "ocean type" juveniles, generally move out and into deeper water upon entry into estuarine waters. The separation between these life history strategies are both genetic and morphological and are also commonly manifested in adult migration return timing into freshwater. The "stream type" adults generally return earlier in the year than the "ocean type" and can be found holding in pools prior to spawning. After spending from a few weeks to a few months in estuarine areas, the juveniles move into the North Pacific Ocean where

they reside for one to 6 or more years. At the end of the ocean residence period, they return as mature adults to their natal rivers and spawning grounds. At spawning, the eggs are deposited in nests, called redds, where they remain for varying periods of time depending on stock and location. Hatching and emergence generally occur in late winter or early spring. This completes the overall life "cycle" from the juvenile stage, as either "stream" or "ocean" type juveniles to spawning adults.

Rivers in this ESU are all contained within the Puget Sound Basin, specifically, they drain the west slope of the Cascade Mountains, the east and northeast slopes of the Olympic Mountains, and the north side of the lowlands that separate southern Puget Sound from the Chehalis River drainage. The Puget Sound river systems are generally short compared to systems like the Columbia River and are subject to multiple floods in any given year. Some of these rivers have glaciers at their headwaters, others do not.

The life history stage relevant to this consultation is the freshwater residence, juvenile out-migratory routes in the Lake Union and Ship Canal area, and nearshore areas used by juveniles that have entered Elliott Bay and/or eastern central Puget Sound. Juvenile chinook salmon in Lake Union and the Ship Canal are most likely migrating to central Puget Sound. When these juveniles are in freshwater they will need to forage and simultaneously are subject to predation (Healey 1991). The "ocean type" juveniles generally move and feed in the nearshore areas. Once in estuarine waters, "ocean type" juveniles from the Cedar and Green/Duwamish rivers will inhabit the shallow nearshore areas moving in and out with the tide as they grow (Healey 1991). As they grow they move into deeper water. The "stream type" juveniles, which are larger, generally outmigrate rapidly from freshwater during the spring time, do little foraging in freshwater during outmigration, and once they reach estuarine waters move rapidly into offshore areas. The "stream type" juveniles can be found in the offshore areas feeding during the spring and summer. These two life history strategies may be a adaptation for the juveniles to partition the food resources, reducing competition to the benefit of both. In late summer both life history types move out of the estuaries and into the North Pacific Ocean where they reside for one to several years.

Artificial Propagation. Artificial propagation programs have had considerable influence on this ESU. Nearly 2 billion juvenile chinook salmon have been released into Puget Sound rivers since the 1950's (64 Fed. Reg. 14307). The preponderance of hatchery production may mask trends in natural populations and makes it difficult to determine whether local naturally spawning stocks are self sustaining. This is compounded by the dearth of data on the proportion of naturally spawning fish that are of hatchery origin. There has also been widespread use of a small number of hatchery stocks, which results in a greater risk of fitness loss and reduction in diversity among populations.

B. Environmental Baseline

Population trends for this ESU are generally downward. Overall abundance has declined substantially from historical levels (64 Fed. Reg. 14307). Both long and short term trends in abundance are predominately downward. NMFS concluded that chinook salmon in this ESU are not presently in

danger of extinction, but they are likely to become endangered in the foreseeable future.

The condition and status of the critical habit in Lake Union and the Ship Canal is degraded. The shoreline of Lake Union and the Ship Canal is almost totally developed with only a few places left that have natural banks and vegetation. The water quality is also degraded by petroleum products from boats, stormwater, sewers, runoff of pesticides and fertilizers from waterfront homes, spills from live-aboards and houseboats, and CSO discharges directly into the Lake Union and the Ship Canal. Most of the shoreline is armored with little overhanging vegetation, whether native or non-native. Lake Washington, only a few miles upstream from Lake Union, is home to as many as 15 to 20 non-native species of fish. Many of these non-native species can be found in Lake Union and the Ship Canal (Wydoski and Whitney 1979). In summary, this environment is not ideally suited for juvenile chinook salmon.

The status and condition of the critical habitat in Elliott Bay and east central Puget Sound is degraded. Most of the Seattle shoreline of Elliott Bay and east central Puget Sound is armored, generally with rock and riprap . The shoreline lacks natural, overhanging vegetation. Historically, overhanging vegetation was probably a major source of nutrients fueling the nearshore food web (Simenstad and Wissmar 1985). Shoreline armoring has stopped most of the erosion from the feeder bluffs along the shoreline. Historically, these bluffs were a source of sediment and large trees, each supporting structural and biological habitat elements for juvenile salmon. Specifically, sediment from this source was probably important as a substrate for eelgrass and small crustaceans, important habitat and food resource (respectively) for juvenile salmon. Ample portions of waterfront land have been created by filling what was once intertidal beach. To accomplish this, bulkheads were built in the intertidal areas using rock and other erosion-resistant materials and then the spaces behind these bulkheads were filled to create dry land. The result is a shoreline that is not only armored, but much steeper compared to natural shorelines; and usually without the trees and natural vegetation that can be found in undeveloped shorelines. This armoring has generally altered the substrate from soft material and a gently sloping incline to hard material with a steep incline. These changes reduced availability of prey items and preferred habitat for juvenile salmon, thus reducing the probability of survival of those stocks of chinook salmon that depend on these areas as habitat.

The water and sediment quality of Elliott Bay and east central Puget Sound is variously degraded to properly functioning, depending on specific location. Typically, water quality suffers from street runoff, CSO discharges, petroleum products from various human activities, treated and untreated effluent discharges, pesticides and fertilizers, and garbage from people working and living on the water. The nearshore sediment ranges from contaminated to clean. Various levels of contamination can be found in sediment and contaminants include heavy metals, Poly Aromatic Hydrocarbons (PAHs), and a variety of other compounds. The waterfront adjacent to Seattle and the Duwamish Estuary contain contaminants from turn-of-the-century activities, industrial liquid wastes, and the deliberate dumping of material into the nearshore waters of Elliott Bay and the Duwamish River. All of these materials have contributed to the contamination sediments in the Duwamish River and Elliott Bay. These contaminated

sediments can become "mobilized" via turbulence from ship propellor wash. Mobilization involves the suspension of bottom sediment into the water column during a turbulence event. Mobilization can result in contaminants moving from one location to others, therefore even without a specific source of contamination a given location, a site that has been cleaned-up can become recontaminated. Some of the nearshore benthic environment has been cleaned up or covered up to "cap" toxic sediments. Thus, there is a patchwork of sediment that ranges from clean to contaminated.

The major sources of contamination in sediments is discussed above. CSOs are an additional source of contamination. The combined sewage and stormwater released from CSOs during storm events contribute to water and sediment quality degradation. Water soluble fractions are most likely removed from Puget Sound through natural processes before they can become a problem for chinook salmon since most of the storm events that cause the majority of CSO discharges occur during the winter months when juvenile chinook are not present in Elliott Bay. However, particulate and floatable fractions within effluent discharges can adversely impact the nearshore sediments. The particulate fraction, especially the portion that is more dense than the overall outfall effluent can be deposited in the vicinity of the outfalls and accumulate. The floatables rise in the water column and enter the microlayer and then become concentrated in windrows that are then moved by currents and wind onshore where the contamination can accumulate, especially in the intertidal substrate.

In summary, the environmental baseline for both the freshwater and estuarine areas of concern to this consultation are degraded. Almost any action that reduces or eliminates sources and amounts of contaminated materials will be beneficial to the Cedar and Green/Duwamish chinook salmon stocks.

IV. EFFECTS OF THE ACTION

The effects of the action will occur in fresh and marine waters, primarily impacting two stocks of chinook salmon. In freshwater, the action will effect the Cedar River/Lake Washington basin stock of chinook salmon. In marine waters, the proposed action will affect the Green/Duwamish River stock. To a much lesser degree, the project will affect the Cedar River/Lake Washington basin stock and other stocks that may use Elliott Bay and east central Puget Sound as a forage and migration area. Effluent from this action will be split between three outfall locations: two in Elliott Bay, one at -20 feet MLLW, the other at -50 to -60 feet MLLW, offshore of the shallower outfall, and the third outfall location is the West Point Sewage treatment facility outfall located in deep water (~233 feet) generally north of West Point.

A. Direct Effects

Direct effects are the direct or immediate effects of the project on the species or its habitat. Direct effects result from the agency action, including the effects of interrelated actions and interdependent actions. Future Federal actions that are not a direct effect of the action under consideration (and not

included in the environmental baseline or treated as indirect effects) are not considered in this consultation as they will be the subject of separate consultations under Section 7 of the ESA.

Direct effects of the action are centered about the construction of the Denny Way CSO, the Primary Treatment Outfalls, and the removal of the CSO number 125 from Lake Union. The direct effects from the removal of CSO number 125 will be insignificant to listed species. There may be a small plume of sediment during outfall removal, but this work will be done during the time of the year when fish are not present and there will be an extremely low probability of impact to chinook salmon.

The construction work that will accompany the installation of two outfalls in the marine environment will involve trenching, piling driving, pipe installation and backfilling the trench. Once the pipe leaves the trench it will be placed on the bottom and covered with a "concrete mattress" for protection from fishing gear and anchors. The effects of these activities will be very limited and should not cause significant harm to listed species because the work will be done during a time of the year when juvenile salmon are not present and most of the disturbance to the substrate will have recovered prior to the spring forage season. The trench is sufficiently narrow that any benthic and epibenthic community displaced by construction should return quickly, generally within the first year after construction. Since the work is scheduled during late summer to mid-winter, after the fish leave the area, benthic and epibenthic communities should have recovered in the disturbed areas by the following spring.

The added underwater "structure" placed in the nearshore and intertidal areas will add directly to salmonid habitat by increasing the area of attachment places for macro algae. The large woody debris will act as both habitat for small crustaceans and a source of nutrients for the nearshore food webs.

1. Lake Union/Ship Canal

The removal of the one CSO outfall (number 125) from Lake Union will improve conditions over the baseline. This work should be completed while juvenile salmon are not present, and should therefore have an insignificant effect on the Cedar River/Lake Washington basin chinook salmon stock. Once the CSO outfall is removed and controlled, and effluent is routed away from Lake Union, the water and sediment quality should improve, especially in the nearshore areas. Overall, this action is positive for Lake Union and the Ship Canal, since the amount of contaminants entering these water bodies will be decreased. The remaining CSOs will be controlled to one event per year per outfall and the CSO volume will be reduced from 100 mg/year (current condition) to 1 mg/year after project completion.

2. Elliott Bay

The proposed action includes two distinct phases in Elliott Bay. One is the construction of the two outfalls, the other is the operation of these outfalls. The CSO is to be located in about -20 feet of water (MLLW) and about 120 feet offshore. The other treated CSO outfall will be

located about 490 feet offshore in about -50 to -60 feet MLLW. The CSO outfall will serve as an overflow outlet if the storage facility under Mercer Street is overwhelmed by a major storm event, or during a power failure. In these types of events, the CSO will discharge untreated combined sewage and stormwater into Elliott Bay. The design specifications call for this to happen only once per year, on average. The release of untreated effluent will adversely effect the water quality of Elliott Bay, at least during and shortly after the event. Furthermore, such discharges will adversely effect nearshore and intertidal sediment. Sediment effects will most likely remain, and lead to the accumulation of contaminants in these sediments. Some contaminants are bioactive and will find their way into the food chain and may result in reduced probability of survival of salmon that forage in the impacted areas. Importantly, the occurrence of such events will be limited to once per year by design.

The outfall discharging treated CSO combined sewage and stormwater located at -50 to -60 feet MLLW will release material that has undergone CSO treatment. CSO treatment involves the removal of "settleables and floatables," specifically this means that particulates that are more dense than the effluent will settle out before discharge of the treated effluent. Additionally, some floatable materials will be removed by screens. A large amount of the toxic material, especially heavy metals, adhere to particulates and are thus removed with the settleables. It is expected that CSO treatment will achieve about 18% removal of suspended solids. The screening process removes additional contaminated material. Remaining contaminants will find their way into the water where, via wind and currents, they will be moved inshore and thus find their way into the sediment and then into the juvenile salmon food chain.

3. East Central Puget Sound

The proposed action will eventually lead to increased amounts of treated effluent into the deep waters via the West Point Treatment facility outfall. The effluent from the treatment plant has undergone secondary treatment and the majority, but not all, of contaminants have been removed. This effluent is put into the water column at a depth that moves most of the material out of Puget Sound. Most of the material that is released from the outfall will move out of Puget Sound without reaching the surface or coming in contact with the benthos, thus it is not of concern to this consultation. However, as much as ten percent of the effluent may reach the surface microlayer and might cause adverse effects to aquatic organisms (Hardy et al. 1987(a), Word et al. 1990) and therefore chinook salmon juveniles. The microlayer is discussed in the next section.

Non site-specific effects. Project activities will affect the microlayer, the thin (generally 10 to 100 microns) surface layer of the water column. The microlayer in the action area contains contaminated materials that are known to be toxic to aquatic organisms (Cross, et al. 1987, Hardy 1997, Hardy, et al. 1997, Hardy and Cleary 1992, Hardy, et al. 1990, Hardy, et al. 1987(b). As much as 10% of the mass of the effluent from the Renton Plant outfall finds its

way into the microlayer in as short a time as 12 to 24 hours after discharge (Word, et al. 1990). Since the Renton and West Point treatment plants are both secondary treatment plants, the West Point outfall effluent probably also finds its way into the microlayer. The microlayer is a naturally occurring feature on the surface of water bodies. In Puget Sound, the primary source of material in the microlayer is decomposition of plankton where the light materials from decomposition (generally oils) float to the surface where they form into windrows. Another source of material to the microlayer is anthropogenic - from sewage outfalls and other sources. The material from sewage outfalls that makes its way to the surface concentrates in the microlayer and is then moved around by winds and currents. There are three major fates of this material: 1) photo decomposition of the material that can be decomposed this way, 2) material is transported out of Puget Sound, and 3) material deposits on intertidal substrate - this is similar to what happens in the formation of a bathtub ring. Of concern to this consultation is the material that deposits in the intertidal. There are two major ways that this material might effect chinook salmon: 1) direct toxic effects to juveniles migrating and foraging in areas where microlayer concentrated toxic compounds are located, and 2) the contaminants that deposit on the intertidal substrate may be incorporated and concentrated in the benthic food chain and subsequently eaten by juvenile salmon. Depending on tissue concentrations, these contaminants may reduce the probability of survival of juvenile chinook salmon.

4. Nearshore Structure

The installation of the "structure" in the nearshore and intertidal area of the Elliott Bay project site will add value to the salmonid habitat. The boulders and large woody debris will enhance the production of macro algae and small crustaceans that are preyed on by juvenile salmon.

Effects of Interdependent and Interrelated Actions. Regulations implementing the Act of 1973, as amended, require that the NMFS consider the effects of the activities which are interrelated and interdependent to the proposed Federal action (50 CFR Part 402.02). The Act defines interrelated activities as those which are part of a larger action and depend upon the larger action for their justification, and interdependent activities as those projects which have no independent utility apart from the action that is under consideration. Both interrelated and interdependent activities may be addressed by applying the "but for" test, which evaluates whether any action and its associated impacts would occur "but for" the proposed action.

The construction of the outfalls will lead the operation of the facilities and the subsequent (albeit reduced) contamination of the local environment. The removal of the CSO outfalls in Lake Union will have the interrelated action of reducing the discharge of untreated effluent into the lake and Ship Canal. The effects of these actions have been described above.

In summary, the activities underlying the proposed action will have both adverse and beneficial direct effects on listed salmon. The removal and control of CSO outfalls in Lake Union will

have a positive impact to the Lake Union and Ship Canal environment. The addition of "structure" to the Elliott Bay construction area will positively impact salmon habitat. The construction activities of the Denny Way CSO and associated outfalls will not have a significant effect on listed salmon if it is done during the time of the year when juvenile chinook salmon are not present. The operation of the storage and treatment system will have adverse impacts to listed salmon via the release of contaminated materials to the environment and subsequent accumulation in the nearshore and intertidal sediments. However, the amount released to the environment will be substantially reduced over current levels. Therefore, even though contaminated material will continue to be introduced to the environment, it will be at a much lower rate, from over 50 CSO events per year to one CSO event per year. Overall, the risk to the listed species from this project is small. It is certainly less than doing nothing at all. By building the proposed facility, the amount of untreated combined sewage and stormwater that enters Lake Union and Elliott Bay will be reduced, thus reducing the rate of contamination into the nearshore environment and subsequent effects to listed chinook salmon.

B. Indirect Effects

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action. Indirect effects may include other Federal actions that have not undergone Section 7 consultation but will result from the action under consideration. These actions must be reasonably certain to occur, or they are a logical extension of the proposed action.

Indirect effects of the proposed action can be described in two ways. Such effects include general environmental effects that flow from the operation of the projects after construction is complete. Indirect effects for the purposes of this consultation specifically relate the species responses to those operations. The effects of the operation of the system include release of contaminated materials into the water column. These materials include contaminated particulate materials, some of which are sufficiently dense that they will settle out near the outfalls; and a light fraction from the effluent (floatables) that can become entrained in the upper water column and microlayer and subsequently find its way to the nearshore and/or intertidal and then either contaminate (if the substrate is clean) or add contamination (if the substrate is contaminated) to the substrate. Given the current state of the technology, these effects are unavoidable; probably the best that can be done is to minimize the effects by reducing, to the extent possible, the volume of contaminated material released to the environment.

C. Species' Response to the Effects of the Proposed Action

The construction and operation of treated and untreated CSO outfall pipes may cause a reduction in acceptable habitat for juvenile chinook salmon in the nearshore estuarine areas of Elliott Bay and eastern central Puget Sound. There will be short-term and long-term effects on juvenile chinook salmon habitat, specifically the trenching, pile driving and outfall pipe placement. The trench will be

confined to an area that is less than 40 feet wide and extend to about 120 feet offshore. Within one or two years after construction most of the impacts to the benthic community will be undetectable and the food web (chain) will have been be reestablished in the trenched area. The area that will be impacted by the construction will be minimal (less than .0003 percent) compared to the total area of similar depth in Elliott Bay. In addition to the trench, an additional 380 feet of outfall pipe will be laid. To accomplish this, piling will be driven into the substrate and capped with a cradle that will hold the outfall pipe. The top of the cradle will be at the substrate surface level and thus the outfall pipe will be located at the level of the substrate. After the outfall pipe is in place it will be covered with a cement blanket to protect it from fishing gear, anchors, etc. The area occupied by the cover will not provide necessary habitat for the food organisms of juvenile chinook salmon, in effect the productivity of the benthos will be reduced, albeit very little, as a fraction of all comparable habitat in Elliott Bay and the estuarine action area.

The construction activities and outfall pipe installation will have short term effects that should recover within one to two years after disturbance. The outfall pipe construction will also have a long-term impact that will result in the loss of benthic invertebrate habitat for a prolonged period of time, at least on the scale of decades. However, the amount of benthic invertebrate habitat that will be lost is very small compared to all of this type of habitat available in the Elliott Bay and eastern central Puget Sound area. Any juvenile chinook salmon that encounter this disturbed area after construction will find a swath of substrate with fewer available forage organisms; however, the juveniles will continue to search for food and given that the swath is less than 40 feet wide, they will readily find food a short distance away. Thus, the effects to the species from construction will be minimal and probably undetectable.

The operation of the entire system, however, is a different matter. The combined sewage and stormwater from the CSO outfalls, and the West Point Treatment Plant outfall may have long-term consequences for juvenile chinook salmon. The fate of the effluent released from the outfalls is detailed above, but in summary will either: 1) leave Puget Sound, 2) enter the substrate near the outfalls, or 3) enter the nearshore and intertidal substrate. The effluent that leaves Puget Sound is not of concern to this consultation. The treated effluent that enters the substrate near the CSO treatment- and West Point Treatment Plant-outfalls is likewise of little concern since these outfalls and their surrounding substrate are located in over 50 feet of water. Juvenile chinook salmon can be found to depths of about 40 feet (Healey 1991). The effluent from the treated and untreated CSO-, and West Point Treatment Plant-outfalls that reaches the surface and near surface waters and finds its way into the nearshore and intertidal areas of Elliott Bay and east central Puget Sound may have an adverse impact to juvenile chinook salmon. The mechanism is detailed above, but a summary is that contaminants from the outfalls that enter the substrate may find it way into the food chain, subsequently be ingested by juvenile salmon, and this may result in a reduction in the probability of survival (Tracy Collier, personnel communication). Over time, on the scale of years to decades, King County data (see Appendix C) indicate that several contaminants will accumulate in the substrate. This accumulation, if it reaches sufficient concentrations, can cause adverse impacts to juvenile salmon growth rates and result in reduced survival. However, the current state of affairs where there are about 50 to 75 untreated

effluent CSO discharges into Elliott Bay and Lake Union is much more detrimental to juvenile chinook salmon when compared to the expected circumstances after the project is up and running. The untreated discharges of combined sewage and stormwater into Lake Union, the subsequent contamination of the nearshore substrate, and the fact that heavy metals are known to be more toxic in freshwater that saltwater, means that the reduction of combined sewage and stormwater into Lake Union will be an overall benefit to the Puget Sound chinook salmon ESU. Once the project is operational, the amount of untreated combined sewage and stormwater that enters the action area will be greatly reduced over current conditions. Some of the settleable particulates, which will have contaminants adhering to them, will be removed. The amount of untreated water will be drastically reduced and the time of the year when the untreated event occurs (generally winter) will be when the Duwamish River is also at higher water flows thus assisting in the flushing of the effluent. The reduction in contaminated material reaching the Puget Sound environment and the reduced rate of accumulation in the sediments will be an improvement over current effluent and contaminate accumulation circumstances, but will not be a sufficient reduction in contamination to result in no adverse impacts.

The "structure" (boulders and large logs) added to the nearshore and intertidal benthos will enhance salmonid habitat in several ways including added food resources. The effects to the species is generally positive and the large woody debris is particularly valuable since so much of this material has been lost in the nearshore areas over the last 100 to 200 years. This is a small step to return some of the function that was, once upon a time, part of the nearshore and intertidal habitat of Puget Sound.

Given the information on the existing environmental baseline, status of the species and effects of construction, subsequent operation of the project and added "structure," it is unlikely that the proposed project will jeopardize the continued existence of the Puget Sound chinook salmon ESU.

D. Cumulative Effects

Cumulative effects include the effects if future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the act.

There are not any on-going Federal or non-Federal management activities within the action area that this Biological Opinion addresses. There may be future Army Corps of Engineers' actions, but actions would require review under Section 7 of the Endangered Species Act.

The major cumulative effects that occur in Elliott Bay and to some degree in eastern central Puget Sound are oil spills from bilges, fueling, and leaking vessels; antifouling paint sloughing from vessel bottoms; remobilized contaminated sediment caused by vessel propellor wash; and contaminated Duwamish River sediment.

Oil spills have many sources, some of which are given above. The amount of material from any given spill is generally small, but can be many thousands of gallons depending on the event. Although illegal, bilge pumping when no-one is looking or after dark occurs and is a constant source of contamination. Fueling of vessels can result in a source of surface oil films and can frequently be observed near fuel docks. Accidents where oil barges or ship fuel tanks are ruptured can result in large amounts of fuel oils spilled; fortunately, these events are infrequent, but when they occur the amount of oils spilled can be very large.

Vessels are another source of contamination via antifouling or bottom paint. This paint is put on vessel bottoms to discourage aquatic growth on the hull that can result in decreased speed or more fuel consumption to overcome the increase friction due to aquatic growth. This antifouling paint sloughs off over time, generally 1 to 3 years, and deposits in the substrate. One of the common antifouling paints is tri-butylating and has been linked to reduced survival of juvenile salmon (James Meador, personnel communication).

When vessels of sufficient size and power, such as ferry boats, operate near the shoreline, they will stir up the sediment and create a sediment plume. Vessels that do this in areas where there is contaminated sediment can cause the mobilization of this material and result in the contaminated material drifting with the currents for some distance, thus moving contaminated material further "downstream" and perhaps contributing contamination to places such as existing outfall sites.

The Duwamish River has contaminated sediment that can become mobilized into the water column, especially when it floods. This material can be moved "downstream" and add to the contamination of the sediment near CSO outfalls in Elliott Bay.

Overall, these sources of contaminated sediment far outweigh the amount of contamination that will be put into Puget Sound marine waters from the proposed project.

V. CONCLUSION

After reviewing the current status of chinook salmon, the environmental baseline for the action area, the effects of the proposed project, and the cumulative effects, it is the NMFS' biological opinion that the proposed project is not likely to jeopardize the continued existence of Puget Sound chinook salmon. Furthermore, critical habitat for chinook salmon will likely not be destroyed or adversely modified. This determination is based on the following analysis: 1) The total amount of habitat impacted by the construction of the outfalls will be far less than .0003% of the area used by juvenile chinook salmon in Elliott Bay, eastern central Puget Sound and the Ship Canal, 2) the total amount of desirable habitat removed from production of benthic and epibenthic invertebrates is far less than .0001% of the total area of similar depth, 3) the removal of the two CSO outfalls in Lake Union will be an overall benefit to the ESU, 4) the shifting of effluent discharge from freshwater to the marine waters will significantly reduce the toxicity of heavy metals, 5) the timing of the construction will be after the juvenile chinook

salmon have migrated out of the project areas, 6) treatment of the majority of the combined sewage and stormwater will significantly reduce the contaminants in the discharged effluent, 7) once the entire system is up and running it will reduce the number of untreated discharges of effluent by a factor of at least 50, 8) the amount of untreated effluent will be significantly reduced over current circumstances, and 9) large woody debris and large boulders will be added to the substrate which should improve juvenile salmon habitat in the area. Therefore, the proposed action will not jeopardize the recovery of chinook salmon; and accordingly, the NMFS believes this project, as proposed, will not compromise either the recovery or survival of the species

VI. REINITIATION OF CONSULTATION

As provided in 50 CFR 402.16, reinitiation of formal consultation is required when discretionary Federal agency involvement or control over the action has been maintained and if (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to chinook salmon or its critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of the incidental take is exceeded, any operations causing such take must cease pending reinitiation.

VII. INCIDENTAL TAKE STATEMENT

Section 9 of the Act, as amended, prohibits taking (harass, harm, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The reasonable and prudent measures described below are non-discretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in Section 7(o)(2) to apply. If the EPA (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. Implementation of the proposed action is not expected to result in the direct mortality of any listed species.

A. Amount or Extent of Incidental Take

The NMFS anticipates that an undetermined number of Puget Sound chinook salmon may be taken as a results of full implementation of the proposed action. The actual number of individual fish taken as a result of the underlying project is impossible to determine. Incidental take is difficult to quantify because: 1) dead chinook salmon juveniles that can be attributed to the effects of the project are difficult to find, and 2) the absence of juveniles in the project area is not conclusive proof of modification of the habitat. The NMFS anticipates that the benthic and epibenthic invertebrate abundance many be depressed in the construction area within Elliott Bay for one to two years. The NMFS also believes that sediment in the area of the new outfalls may become contaminated over time, years to decades. The qualitative results of such effects can be described in this opinion, but no techniques presently exist to correlate those effects with the potential numerical extent of take. Therefore, for the purposes of this opinion, the extent of take is correlated to the extent of habitat affected. Accordingly, the reasonable and prudent measures were developed to address the extent of habitat effects, as described below.

The NMFS will be notified within 24 hours upon locating a dead, injured, or sick chinook salmon specimen. Initial notification must be made to the nearest NMFS Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact our regional law enforcement office at (206)526-6133 or (360)676-9268.

In the accompanying Biological Opinion, the NMFS determined that this level of anticipated incidental take is not likely to result in jeopardy to chinook salmon, or critical habitat for chinook salmon because this project, as proposed, will not compromise either the recovery or survival of the species due to the small amount of habitat effected in Elliott Bay and east central Puget Sound.

B. Reasonable and Prudent Measures

The NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take:

1. Protect juvenile chinook salmon through the use of an appropriate construction period. In-water construction will not occur during the nearshore estuarine migratory and rearing period.

2. Chinook salmon will be protected from exposure to contaminated sediment.

C. Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the EPA and the applicant, King County, must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. In-water construction will not occur from March 15 through July 15 of any year.

2a. Any contaminated material, removed during the trenching operation, will be disposed of in an approved upland disposal site(s). Criteria for contamination will be defined by Washington State Sediment Standards.

2b. King County will monitor the sediments in the area of the outfalls (treated and untreated) for the entire life of the project based on the sampling plan in Appendix D. If levels of contamination in the sediment from operation of the outfalls reaches, or exceeds, those listed in Appendix D, King County shall remove the contaminated sediment and dispose of it in an approved upland disposal site(s). If this is impractical and a review of the contamination by disinterested party or parties concludes that the sediment can be successfully capped, then this will be the approved method.

The reasonable and prudent measures, with their implementing terms and conditions are designed to minimize incidental take that might otherwise result from the proposed action. If the action is modified, causing an increase in disturbance levels, such elevated disturbance would imply an increase of incidental take and represent new information requiring review of the reasonable and prudent measures provided. The EPA and its client King County must immediately provide an explanation of the causes of the taking and review with the NMFS the need for possible modification of the reasonable and prudent measures.

VIII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans or to develop information.

The NMFS recommends that the following conservation measures be implemented, after discussing the proposed project with the EPA and King County:

1. The action proponent should manage the project to minimize impacts to the benthic

nearshore and intertidal habitat in the project area.

2. NMFS should be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

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APPENDIX A
Letter from EPA

APPENDIX B

The Biological Assessment

APPENDIX C

Spreadsheet model of concentrations of contaminants the sediment over time for Mercury, Copper, Lead, 1-4 DCB, and PCB

APPENDIX D

Benthic (Sediment) Sampling Plan